

Query/Command : his

File : PLUSPAT

SS Results
1 2 (1) ..FAM US20030045074/PN
2 2 (1) ..FAM WO03021640/PN

1 / 2 PLUSPAT - ©QUESTEL-ORBIT - image

PN - WO03021640 A2 20030313 [WO200321640]
PN2 - WO03021640 A3 20030417 [WO200321640]
TI - (A2) METHOD FOR SEMICONDUCTOR GATE DOPING
OTI - (A2) PROCEDE DE DOPAGE DE GRILLE A SEMI-CONDUCTEUR
LA - ENGLISH (ENG)
PA - (A2) ULTRATECH STEPPER INC (US)
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PA2 - (A3) ULTRATECH STEPPER INC (US)
IN - (A2) SEIBEL CINDY; TALWAR SOMIT
AP - WOUS0226362 20020815 [2002WO-US26362]
PR - US94181701 20010829 [2001US-0941817]
IC - (A2) H01L-021/00 H01L-021/26 H01L-021/336 H01L-021/425
EC - H01L-021/8238G4
DS - JP; KR; European patent (AT; BE; BG; CH; CY; CZ; DE; DK; EE; ES; FI; FR; GB; GR; LU; MC; NL; PT; SE; SK; TR)
DT - Basic
CT - Cited in the search report
 US5966605(A)(Cat. Y); US6365476(B1)(Cat. Y,P);US6274488(B1)(Cat. Y);US60777581(Cat. Y)
 VAN ZANT: 'Microchip fabrication', 2000, MCGRAW-HILL PUBLISHING XP0029606
 Fourth edition, pages 331, 403-404, 411(Cat. Y)
STG - (A2) Publ. Of int. Appl. W/out int. Search rep
STG2 - (A3) Subsqu. Publ. Of int. Search report
AB - A method of forming a doped polycrystalline silicon gate in a Metal Oxide Semiconductor "MOS" device. The method includes forming first an insulation layer 114 on a top surface of a crystalline silicon substrate 106. Next, an amorphous silicon layer 200 is formed on top of the insulation layer 114 and then a dopant is introduced in a top surface layer 220 of the amorphous silicon layer 200. The top surface 220 of the amorphous silicon layer 200 is irradiated with a laser beam 230 and the heat of the radiation causes the top surface layer 220 to melt. This initiates explosive recrystallization "XRC" of the amorphous silicon layer 200. The XRC transforms the amorphous silicon layer 200 into a polycrystalline silicon gate and distributes the dopant homogeneously throughout the polycrystalline gate.
UP - 2003-12

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PN - US2003045074 A1 20030306 [US20030045074]
TI - (A1) Method for semiconductor gate doping
IN - (A1) SEIBEL CINDY (US); TALWAR SOMIT (US)
AP - US94181701 20010829 [2001US-0941817]
PR - US94181701 20010829 [2001US-0941817]
IC - (A1) C30B-001/00 H01L-021/3205 H01L-021/336 H01L-021/4763
EC - H01L-021/8238G4
PCL - ORIGINAL (O) : 438486000; CROSS-REFERENCE (X) : 438592000 438308000

- STG** - (A1) Utility Patent Application published on or after January 2, 2001
- AB** - A method of forming a doped polycrystalline silicon gate in a Metal Oxide Semiconductor (MOS) device. The method includes forming first an insulation layer on a top surface of a crystalline silicon substrate. Next, an amorphous silicon layer is formed on top of and in contact with the insulation layer and then a dopant is introduced in a top surface layer of the amorphous silicon layer. The top surface of the amorphous silicon layer is irradiated with a laser beam. The heat of the radiation causes the top surface layer to melt and initiates explosive recrystallization (XRC) of the amorphous silicon layer. The XRC process transforms the amorphous silicon layer into a polycrystalline silicon gate and distributes the dopant homogeneously throughout the polycrystalline gate.
- UP** - 2003-12



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(19) United States

(12) Patent Application Publication (10) Pub. No.: US 2003/0045074 A1

Seibel et al.

(43) Pub. Date:

Mar. 6, 2003

(54) METHOD FOR SEMICONDUCTOR GATE
DOPING

(52) U.S. Cl. 438/486; 438/592; 438/308

(76) Inventors: Cindy Seibel, Cameron Park, CA (US);
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ABSTRACT

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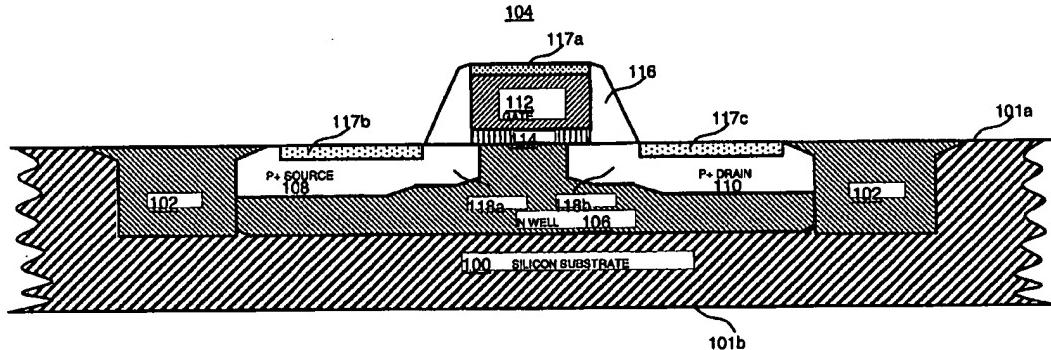
(21) Appl. No.: 09/941,817

(22) Filed: Aug. 29, 2001

Publication Classification

(51) Int. Cl.⁷ H01L 21/336; C30B 1/00;
H01L 21/3205; H01L 21/4763

A method of forming a doped polycrystalline silicon gate in a Metal Oxide Semiconductor (MOS) device. The method includes forming first an insulation layer on a top surface of a crystalline silicon substrate. Next, an amorphous silicon layer is formed on top of and in contact with the insulation layer and then a dopant is introduced in a top surface layer of the amorphous silicon layer. The top surface of the amorphous silicon layer is irradiated with a laser beam and the heat of the radiation causes the top surface layer to melt and initiates explosive recrystallization (XRC) of the amorphous silicon layer. The XRC process transforms the amorphous silicon layer into polycrystalline silicon gate and distributes the dopant homogeneously throughout the polycrystalline gate.



| Set | Items | Description |
|-----|---------|--|
| S1 | 82 | AU= (SEIBEL C? OR SEIBEL, C? OR TALWAR S? OR TALWAR, S?) |
| S2 | 146212 | AMORPHOUS |
| S3 | 1045224 | SILICON? OR SI OR POLYSILICON? OR POLY()SILICON? |
| S4 | 3575 | LASER? (6N) ANNEAL? |
| S5 | 11 | S1 AND S2 AND S3 AND S4 |
| S6 | 288794 | XCR OR EXPLOSIVE(2N)RECRYSTALLI? OR CRYSTALLI? |
| S7 | 11 | S5 AND S6 |
| S8 | 11 | IDPAT (sorted in duplicate/non-duplicate order) |
| S9 | 11 | IDPAT (primary/non-duplicate records only) |

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File 347:JAPIO Oct 1976-2003/Feb (Updated 030603)
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File 348:EUROPEAN PATENTS 1978-2003/Jun W04
(c) 2003 European Patent Office

File 349:PCT FULLTEXT 1979-2002/UB=20030626, UT=20030619
(c) 2003 WIPO/Univentio

File 350:Derwent WPIX 1963-2003/UD, UM &UP=200341
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7/TI,PN,AU,AB,AD,PD,AN/1 (Item 1 fr m file: 348)
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FABRICATION METHOD FOR REDUCED-DIMENSION INTEGRATED CIRCUITS
HERSTELLUNGSVERFAHREN FUR INTEGRIERTE SCHALTREISE MIT REDUZIERTER
DIMENSION

PROCEDE DE FABRICATION DE CIRCUITS INTEGRES AUX DIMENSIONS REDUITES
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PATENT (CC, No, Kind, Date): EP 1012879 A2 000628 (Basic)
EP 1012879 B1 020904
WO 98034268 980806
APPLICATION (CC, No, Date): EP 98909985 980129; WO 98US1942 980129
PRIORITY (CC, No, Date): US 792107 970131

7/TI,PN,AU,AB,AD,PD,AN/2 (Item 1 from file: 349)
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METHOD FOR SEMICONDUCTOR GATE DOPING
PROCEDE DE DOPAGE DE GRILLE A SEMI-CONDUCTEUR

Inventor(s):

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Patent and Priority Information (Country, Number, Date):
Patent: WO 200321640 A2-A3 20030313 (WO 0321640)
Application: WO 2002US26362 20020815 (PCT/WO US0226362)

English Abstract

A method of forming a doped polycrystalline silicon gate in a Metal Oxide Semiconductor "MOS" device. The method includes forming first an insulation layer (114) on a top surface of a crystalline silicon substrate (106). Next, an amorphous silicon layer (200) is formed on top of and in contact with the insulation layer (114) and then a dopant is introduced in a top surface layer of the amorphous silicon layer (200). The top surface (220) of the amorphous silicon layer (200) is irradiated with a laser beam (230) and the heat of the radiation causes the top surface layer (220) to melt and initiates explosive recrystallization "XRC" of the amorphous silicon layer (200). The XRC process transforms the amorphous silicon layer (200) into a polycrystalline silicon gate and distributes the dopant homogeneously throughout the polycrystalline gate.

French Abstract

L'invention concerne un procede de realisation d'une grille en silicium polycristallin dopee dans un dispositif a semi-conducteur a oxyde metallique (MOS). Ce procede consiste a former d'abord une couche d'isolation sur une surface superieure d'un substrat en silicium cristallin. Par la suite, on forme une couche en silicium amorphe sur la partie superieure de et en contact avec la couche d'isolation, puis on introduit un dopant dans une couche de surface superieure de la couche en silicium amorphe. La surface superieure de la couche en silicium amorphe est soumise a un rayonnement par faisceau laser et la chaleur du rayonnement fait fondre la couche de surface superieure et lance la recristallisation explosive (XRC) de la couche en silicium amorphe. Le processus XRC transforme la couche en silicium amorphe en une grille en

silicium polycristallin et repartit le dopant de maniere homogene a travers la grille en silicium polycristallin.

7/TI,PN,AU,AB,AD,PD,AN/3 (Item 2 from file: 349)
DIALOG(R) File 349: (c) 2003 WIPO/Univentio. All rts. reserv.

**LASER THERMAL PROCESS FOR FABRICATING FIELD-EFFECT TRANSISTORS
PROCEDE THERMIQUE AU LASER PERMETTANT DE FABRIQUER DES TRANSISTORS A EFFET DE CHAMP**

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Patent and Priority Information (Country, Number, Date):

Patent: WO 200235601 A1 20020502 (WO 0235601)

Application: WO 2001US29120 20010917 (PCT/WO US0129120)

English Abstract

A simplified and cost reduced process for fabricating a field-effect transistor semiconductor device (104) using laser radiation is disclosed. The process includes the step of forming removable first dielectric spacers (116R) on the sides (120a, 120b) of the gate (120). Dopants are implanted into the substrate (100) and the substrate is annealed to form an active deep source (108) and an active deep drain (110). The sidewall spacers are removed, and then a blanket pre-amorphization implant is performed to form source and drain amorphized regions (200a, 200b) that include respective extension regions (118a, 118b) that extend up to the gate. A layer of material (210) is deposited over the source and drain extensions, the layer being opaque to a select wavelength of laser radiation (220). The layer is then irradiated with laser radiation of the select wavelength so as to selectively melt the amorphized source and drain extensions, but not the underlying substrate. This causes dopants in the deep source to diffuse into the molten source extension, and dopants in the deep drain to diffuse into the molten drain extension. Upon recrystallization of the extensions, the layer of material is removed, and the FET device is completed using known processing techniques. The above process eliminates the lithography and ion implantation steps normally required for source and drain extension formation, and thereby reduces the manufacturing costs of field-effect transistors.

French Abstract

L'invention concerne un procede simplifie et a cout reduit permettant de fabriquer un dispositif semi-conducteur de transistor a effet de champ (104) au moyen d'un rayonnement laser. Le procede comprend l'etape consistant a former des premiers espaces dielectriques amovibles (116R) sur les cotes (120a, 120b) de la grille (120). Des dopants sont mis en oeuvre dans le substrat (100) qui est recuit de maniere a former une source active profonde (108) et un drain actif profond (110). Les espaces de la paroi laterale sont retires et une implantation de couverture de preamorphisation est ensuite executee, en vue de former des regions amorphisees de la source et du drain (200a, 200b), comprenant des regions d'extension respectives (118a, 118b) s'étendant jusqu'a la grille. Une couche de materiel (210) est deposee sur les extensions de la source et du drain, cette couche etant opaque aux fins de selections d'une longueur d'onde de rayonnement laser (220). La couche est ensuite irradiee au moyen d'un rayonnement laser de longueur d'onde selectionnee, de maniere a fondre, de facon selective, les extensions amorphisees de la source et du drain, mais pas le substrat sous-jacent, les dopants dans la source profonde etant contraints de se diffuser dans l'extension fondu de la source et les dopants dans le drain profond etant contraints de se

diffuser dans l'extension fondu du drain. Au moment de la recristallisation des extensions, la couche de matériau est retirée et le dispositif de transistor à effet de champ est achevé au moyen de techniques de traitement connues. Le procédé selon l'invention permet d'éliminer les étapes de lithographie et d'implantation ionique, généralement requises pour une formation d'extensions de source et de drain, réduisant ainsi les coûts de fabrication de transistors à effet de champ.

7/TI,PN,AU,AB,AD,PD,AN/4 (Item 3 from file: 349)
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**THERMALLY INDUCED PHASE SWITCH FOR LASER THERMAL PROCESSING
COMMUTATION DE PHASE CAUSEE PAR UN PHENOMENE THERMIQUE, SERVANT AU
TRAITEMENT THERMIQUE PAR LASER**

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Patent and Priority Information (Country, Number, Date):

Patent: WO 200223279 A1 20020321 (WO 0223279)
Application: WO 2001US42075 20010907 (PCT/WO US0142075)

English Abstract

A method, apparatus and system for controlling the amount of heat transferred to a process region (30) of a workpiece (W) from exposure with a pulse of radiation (10), which may be in the form of a scanning beam (B), using a thermally induced phase switch layer (60). The apparatus of the invention is a film stack (6) having an absorber layer (50) deposited atop the workpiece, such as a silicon wafer. A portion of the absorber layer covers the process region. The absorber layer absorbs radiation and converts the absorbed radiation into heat. The phase switch layer is deposited above or below the absorber layer. The phase switch layer may comprise one or more thin film layers, and may include a thermal insulator layer and a phase transition layer. Because they are in close proximity, the portion of the phase switch layer covering the process region has a temperature that is close to the temperature of the process region. The phase of the phase switch layer changes from a first phase (e.g., solid) to a second phase (e.g., liquid or vapor) at a phase transition temperature ($T_{sub}p$). During this phase change, the phase switch layer absorbs heat but does not significantly change temperature. This limits the temperature of the absorber layer and the process region since both are close to the phase change layer.

French Abstract

La présente invention concerne un procédé, un appareil et un système permettant de commander la quantité de chaleur transférée sur une région de processus (30) d'une pièce à travailler (W), à partir d'une exposition à une impulsion de rayonnement (10) qui peut se présenter sous forme d'un faisceau de balayage (B), par utilisation d'une couche de commutation de phase causée par un phénomène thermique (60). L'appareil selon cette invention est un empilement de films (6) qui présente une couche d'absorption (50) déposée au-dessus de la pièce à travailler, telle qu'une plaquette en silicium. Une partie de la couche d'absorption recouvre la région de processus. La couche d'absorption吸ue un rayonnement et convertit le rayonnement absorbé en chaleur. La couche de commutation de phase peut comprendre une ou plusieurs couches de film mince et peut présenter une couche d'isolation thermique et une couche de

transition de phase. Du fait de leur proximite, la partie de la couche de commutation de phase qui recouvre la region de processus presente une temperature proche de la temperature de la region de processus. La phase de la couche de commutation de phase varie d'une premiere phase (solide, par exemple) a une seconde phase (liquide ou vapeur, par exemple) a une temperature de transition de phase ($T_{\text{sub}}^{\text{p}}$). Au cours de cette variation de phase, la couche de commutation de phase absorbe de la chaleur, mais ne change pas sensiblement de temperature, ce qui permet de limiter la temperature de la couche d'absorption et de la region de processus, du fait qu'elles sont toutes les deux proches de la couche de variation de phase.

7/TI,PN,AU,AB,AD,PD,AN/5 (Item 4 from file: 349)
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**THERMALLY INDUCED REFLECTIVITY SWITCH FOR LASER THERMAL PROCESSING
MODIFICATEUR DE REFLEXIVITE A COMMANDE THERMIQUE POUR TRAITEMENT THERMIQUE
AU LASER**

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Patent and Priority Information (Country, Number, Date):

Patent: WO 200197275 A1 20011220 (WO 0197275)

Application: WO 2001US13977 20010430 (PCT/WO US0113977)

English Abstract

A method, apparatus and system for controlling the amount of heat transferred to a process region (30) of a workpiece (W) from exposure with laser radiation (10) using a thermally induced reflectivity switch layer (60). The apparatus of the invention is a film stack (6) having an absorber layer (50) deposited atop the workpiece, such as a silicon wafer. A portion of the absorber layer covers the process region. The absorber layer absorbs laser radiation and converts the absorbed radiation into heat. A reflective switch layer (60) is deposited atop the absorber layer. The reflective switch layer may comprise one or more thin film layers, and preferably includes a thermal insulator layer and a transition layer. The portion of the reflective switch layer covering the process region has a temperature that corresponds to the temperature of the process region. The reflectivity of the reflectivity switch layer changes from a low reflectivity state to a high reflectivity state at a critical temperature so as to limit the amount of radiation absorbed by the absorber layer by reflecting the incident radiation. This, in turn, limits the amount of heat transferred to the process region from the absorber layer.

French Abstract

L'invention concerne un procede, un appareil et un systeme destines a reguler la quantite de chaleur transferee a une zone de traitement (30) d'une piece a travailler (W) lors d'une exposition a un rayonnement laser (10), au moyen d'une couche de modification de reflexivite a commande thermique (60). L'appareil de l'invention est forme d'une pile de films (6) comprenant une couche d'absorption (50) deposee sur la piece de travail, telle qu'une plaquette de silic ne . Une partie de la couche d'absorption recouvre la zone de traitement. Cette couche d'absorption absorbe le rayonnement laser et transforme le rayonnement absorbe en chaleur. La couche de modification de reflexivite a commande thermique (60) est deposee sur la couche d'absorption. Cette couche de modification

de reflexivite a commande thermique peut comprendre une ou plusieurs couches de film mince, et comprend de preference une couche d'isolation thermique et une couche de transition. La partie de la couche de modification de reflexivite a commande thermique recouvrant la zone de traitement possede une temperature correspondant a celle de la zone de traitement. La reflexivite de la couche de modification de reflexivite a commande thermique change d'un etat de faible reflexivite a un etat de forte reflexivite a une temperature critique, de facon a limiter la quantite de rayonnement absorbee par la couche d'absorption par reflexion du rayonnement incident. Cela permet de limiter la quantite de chaleur transferee a la zone de traitement par la couche d'absorption.

7/TI,PN,AU,AB,AD,PD,AN/6 (Item 5 from file: 349)
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HIGH-SPEED SEMICONDUCTOR TRANSISTOR AND SELECTIVE ABSORPTION PROCESS FOR FORMING SAME
TRANSISTOR A SEMICONDUCTEURS GRANDE VITESSE ET PROCEDE D'ABSORPTION SELECTIVE UTILISE POUR SA FABRICATION

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Patent and Priority Information (Country, Number, Date) :

Patent: WO 200180300 A1 20011025 (WO 0180300)
Application: WO 2001US7632 20010308 (PCT/WO US0107632)

English Abstract

A high-speed semiconductor transistor and process for forming same. The process includes forming, in a Si substrate (10), spaced apart shallow trench isolations (STIs) (20), and a gate (36) atop the substrate between the STIs. Then, regions (40, 44) of the substrate on either side of the gate are either amorphized and doped, or just doped. In certain embodiments of the invention, extension regions (60, 62 or 60', 62") and deep drain and deep source regions (80, 84 or 80', 84') are formed. In other embodiments, just deep drain and deep source regions (80, 84 or 80', 84') are formed. A conformal layer (106) is then formed atop the substrate, covering the substrate surface (11) and the gate. The conformal layer can serve to absorb light and/or to distribute heat to the underlying structures. Then, at least one of front-side irradiation (110) and back-side irradiation (116) is performed to activate the drain and source regions and, if present, the extensions. Explosive recrystallization (124) is one mechanism used to achieve dopant activation. A deep dopant region (120) may be formed deep in the substrate to absorb light and release energy in the form of heat (122) which then activates the doped regions.

French Abstract

L'invention concerne un transistor a semiconducteurs a grande vitesse et son procede de fabrication. Ledit procede consiste a former, dans un substrat Si (10), des separations (20) se presentant sous la forme de tranches superficielles (STI), et une grille (36) au-dessus du substrat entre les STI. Il consiste ensuite a rendre amorphe et a doper, ou seulement a doper les zones du substrat de chaque cote de la grille. Dans certains mode de realisation de l'invention, les zones d'extension (60, 62 ou 60', 62') et les zones profondes du drain ou de la source (80, 84 ou 80', 84') sont formees. Dans d'autres modes de realisation, seules les zones profondes du drain et de la source (80, 84 ou 80', 84') sont formees. Ledit procede consiste ensuite a former une couche de faible

epaisseur sur le substrat, recouvrant la surface (11) du substrat et la grille. Ladite couche de faible epaisseur sert a absorber la lumiere et/ou a repartir la chaleur dans les structures sous-jacentes. Il consiste encore a proceder a une irradiation frontale (110) et a une irradiation arriere (116), de sorte que les zones du drain et de source et, si elles sont presentes, les extensions, soient activees. La recristallisation explosive (124) est un mecanisme utilise pour l'activation des dopants. Une zone de dopant profonde (120) peut etre formee a une profondeur importante dans le substrat, de sorte qu'elle absorbe la lumiere et degage de l'energie sous forme de chaleur (122), qui active ensuite les zones dopees.

7/TI,PN,AU,AB,AD,PD,AN/7 (Item 6 from file: 349)
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METHODS FOR DETERMINING WAVELENGTH AND PULSE LENGTH OF RADIANT ENERGY USED FOR ANNEALING

PROCEDES DE DETERMINATION DE LA LONGUEUR D'ONDE ET DE LA DUREE D'IMPULSION D'ENERGIE DE RAYONNEMENT UTILISEE POUR LE RECUIT

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Patent and Priority Information (Country, Number, Date) :

Patent: WO 200060655 A1 20001012 (WO 0060655)
Application: WO 2000US5329 20000301 (PCT/WO US0005329)

English Abstract

The invention is directed to methods for determining the wavelength, pulse length, and other features important characteristics of radiant energy used to anneal or to activate the source and drain regions of an integrated transistor device which has been doped through implantation of dopant ions, for example. In general, the radiant energy pulse is determined to have a wavelength from 450 to 900 nanometers, a pulse length of 0.1 to 50 nanoseconds, and an exposure energy dose of from 0.1 to 1.0 Joules per square centimeter.

French Abstract

L'invention concerne des procedes de determination de la longueur d'onde, de la duree d'impulsion et d'autres caracteristiques importantes d'energie de rayonnement utilisee pour le recuit ou l'activation des zones du drain et de la source d'un dispositif transistor integre ayant ete dope par l'implantation, par exemple, d'ions dopants. En general, l'impulsion de l'energie rayonnante presente une longueur d'onde de 450 a 900 nanometres, une duree d'impulsion de 0,1 a 50 nanosecondes et une dose d'exposition de 0,1 a 1,0 Joule par centimetre carre.

7/TI,PN,AU,AB,AD,PD,AN/8 (Item 7 from file: 349)
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METHOD FOR FORMING A SILICIDE REGION ON A SILICON BODY

PROCEDE POUR FORMER UNE ZONE DE SILICIURE SUR UN CORPS EN SILICIUM

Inventor(s) :

TALWAR Somit ,
VERMA Gaurav,
KRAMER Karl-Joseph,
WEINER Kurt

Patent and Priority Information (Country, Number, Date) :

English Abstract

The invented method produces a silicide region on a **silicon** body that is useful for a variety of purposes, including the reduction of the electrical contact resistance to the **silicon** body or an integrated electronic device formed thereon. The invented method includes a step of producing an **amorphous** region on the **silicon** body using ion implantation, for example, a step of forming a metal layer such as titanium, cobalt or nickel in contact with the **amorphous** region, and a step of irradiating the metal with intense light from a source such as a laser, to cause metal atoms to diffuse into the **amorphous** region to form an alloy region with a silicide composition. In an application of the invented method to the manufacture of a MISFET device, the metal layer is preferably formed with a thickness that is at least sufficient to produce a stoichiometric proportion of metal and **silicon** atoms in the **amorphous** region of the gate of the MISFET device. Importantly, the irradiating step proceeds until the metal overlying the gate alloy region is consumed and the gate alloy region is exposed. The gate alloy region has a higher reflectivity than the metal layer, and thus reduces further thermal loading of the gate alloy region so that silicide growth can be continued in the source and drain regions without adversely impacting the gate of the MISFET device. The invention also includes an integrated MISFET device in which the gate silicide region is greater than the source/drain silicide region.

French Abstract

L'invention concerne un procede permettant de produire une zone de siliciure sur un corps en silicium utilise dans de nombreuses applications, notamment pour reduire la resistance d'un contact electrique vis-a-vis dudit corps en silicium ou d'un dispositif electronique integre a ce dernier. Le procede de cette invention consiste tout d'abord a produire une zone amorphe sur le corps en silicium, par exemple par implantation ionique, puis a former une couche metallique de titane, de cobalt, ou de nickel en contact avec cette zone amorphe, et enfin a soumettre ce metal a un rayonnement lumineux intense provenant d'une source telle qu'un laser, afin d'amener les atomes de metal a se diffuser dans la zone amorphe et a former une zone en alliage renfermant une composition de siliciure. Dans l'une des applications de ce procede permettant de fabriquer un transistor MIS, ladite couche metallique presente de preference une epaisseur suffisante pour produire une proportion stoechiometrique d'atomes de metal et de silicium dans la zone amorphe de ce transistor MIS. L'etape d'irradiation se poursuit jusqu'a ce que le metal recouvrant la zone grille en alliage soit epuise, et que cette zone soit exposee. Cette zone grille en alliage presente par ailleurs une reflectivite superieure a celle de la couche metallique, ce qui permet de reduire d'autant la charge thermique sur cette zone, le siliciure pouvant ainsi continuer a croitre dans les zones source et drain sans pour autant nuire a la grille dudit transistor MIS. Cette invention concerne egalement un transistor MIS integre dans lequel la zone grille de siliciure est plus grande que la zone source/drain de siliciure.

**PROCEDE DE RECUISISON LASER AVEC IMMERSION DANS UN GAZ PERMETTANT DE
FABRIQUER DES CIRCUITS INTEGRES DE DIMENSIONS REDUITES**

Inventor(s) :

TALWAR Somit ,

WEINER Kurt

Patent and Priority Information (Country, Number, Date) :

Patent: WO 200013213 A1 20000309 (WO 0013213)

Application: WO 98US25264 19981125 (PCT/WO US9825264)

English Abstract

A method for fabricating a plurality of shallow-junction metal oxide semiconductor field effect transistors (MOSFETs) which are separated by substantially transparent isolation elements (102). This method includes the amorphization of a selected depth of silicon (200) in a silicon wafer. A top layer stack of a dielectric and a highly radiation absorbent material are deposited to protect areas of which amorphization is not desired. After the melted silicon has cooled and recrystallized, the top layer of highly absorbent material is removed.

French Abstract

Cette invention concerne un procede permettant de fabriquer plusieurs transistors a effet de champ, semi-conducteurs, a base d'oxyde metallique et a jonction superficielle (MOSFET) qui sont separees par des elements isolants globalement transparents (102). Ce procede consiste a rendre amorphe une profondeur predeterminee de silicium (200) dans une plaque de silicium. Un empilement de couches superieures se composant d'un materiau dielectrique et absorbant fortement les rayonnements est ensuite applique afin de proteger les zones que l'on ne souhaite pas rendre amorphes. Une fois que le silicium fondu s'est refroidi et recristallise, on enleve la couche superieure faite du materiau fortement absorbant.

7/TI,PN,AU,AB,AD,PD,AN/10 (Item 9 from file: 349)
DIALOG(R)File 349:(c) 2003 WIPO/Univentio. All rts. reserv.

FABRICATION METHOD FOR REDUCED-DIMENSION INTEGRATED CIRCUITS

PROCEDE DE FABRICATION DE CIRCUITS INTEGRES AUX DIMENSIONS REDUITES

Inventor(s) :

TALWAR Somit ,

KRAMER Karl-Josef,

VERMA Guarav,

WEINER Kurt

Patent and Priority Information (Country, Number, Date) :

Patent: WO 9834268 A2 19980806

Application: WO 98US1942 19980129 (PCT/WO US9801942)

English Abstract

Pre-amorphization of a surface layer of crystalline silicon to an ultra-shallow (400) and (402) (e.g., less than 100 nm) depth provides a solution to fabrication problems including (a) high thermal conduction in crystalline silicon and (b) shadowing and diffraction-interference effects by an already fabricated gate of a field-effect transistor on incident laser radiation. Such problems, in the past, have prevented prior-art projection gas immersion laser doping from being effectively employed in the fabrication of integrated circuits comprising MOS field-effect transistors employing 100 nm and shallower junction technology.

French Abstract

La pre-amorphisation d'une couche superficielle de silicium cristallin sur une infime epaisseur (p.ex., inferieure a 100 nm) apporte une

solution aux problemes de fabrication au moyen (1) d'une haute conduction thermique dans le silicium cristallin et (2) d'effets d'ombrage et de telescopage des diffractions par une porte deja fabriquee d'un transistor a effet de champ sur rayonnement laser incident. Dans le passe, ces problemes ont empêche d'utiliser efficacement le dopage laser par immersion de gaz de projection, de la technique anterieure, dans la fabrication de circuits integres comprenant des transistors a effet de champ MOS utilisant une technologie de jonction au 100 nm, voire encore moins.

7/TI,PN,AU,AB,AD,PD,AN/11 (Item 10 from file: 349)
DIALOG(R) File 349: (c) 2003 WIPO/Univentio. All rts. reserv.

METHOD FOR FORMING A SILICIDE REGION ON A SILICON BODY
PROCEDE DE FORMATION D'UNE REGION DE SILICIURE SUR UN CORPS EN SILICIUM

Inventor(s):

TALWAR Somit,
VERMA Guarav,
KRAMER Karl-Joseph,
WEINER Kurt

Patent and Priority Information (Country, Number, Date):

Patent: WO 9833206 A1 19980730
Application: WO 98US314 19980109 (PCT/WO US9800314)

English Abstract

The method of this invention produces a silicide region on a silicon body (1) that is useful for a variety of purposes, including the reduction of the electrical contact resistance to the silicon body (1) or an integrated electronic device formed thereon. The invented method includes the steps of producing an amorphous region (28) on the silicon body (1) using ion implantation (26), for example, forming or positioning a metal (30) such as titanium, cobalt or nickel in contact with the amorphous region (28), and irradiating the metal with intense light (31) from a laser source, for example, to cause metal atoms to diffuse into the amorphous region (28). The amorphous region (28) thus becomes an alloy region with the desired silicide composition. Upon cooling after irradiation, the alloy region becomes partially crystalline. To convert the alloy region into a more crystalline form, the invented method preferably includes a step of treating the alloy region using rapid thermal annealing, for example. An insulator layer (32) and a conductive lead (34) can subsequently be patterned to establish electrical contact to the silicide region. The low contact resistivity of the silicide region provides the capability to transmit relatively high-frequency electronic signals through the contact region. In a preferred application, the invented method is used to form self-aligned silicide contact regions for the gate, source and drain of a metal-insulator-semiconductor field-effect transistor (MISFET).

French Abstract

Le proce de cette invention produit une region de siliciure sur un corps en silicium (1) utile a diverses fins, notamment pour la reduction de la resistance du contact electrique au corps en silicium (1) ou a un dispositif electronique integre forme sur celui-ci. Le proce de l'invention comprend les etapes de production d'une region amorphe (28) sur le corps en silicium (1) par implantation ionique (26), par exemple, de formation et de positionnement d'un metal (30) tel que le titane, le cobalt ou le nickel en contact avec la region amorphe (28), et d'irradiation du metal avec une lumiere intense (31) tiree d'une source laser, par exemple, afin de provoquer la diffusion des atomes de metal

dans la region amorphe (28). La region amorphe (28) devient ainsi une region d'alliage avec la composition de siliciure voulue. Lors du refroidissement apres irradiation, la region d'alliage devient partiellement cristalline. Afin de convertir la region d'alliage en une forme plus cristalline, le procede de l'invention comprend de preference une etape de traitement de la region d'alliage au moyen d'un recuit thermique rapide, par exemple. Une couche d'isolateur (32) et un fil conducteur (34) peuvent ensuite etre configures pour etablir un contact electrique avec la region en siliciure. La faible resistivite de contact de la region en siliciure permet de transmettre des signaux electroniques de frequence relativement haute a travers la region de contact. Dans une application preferree, le procede de l'invention est utilise pour former des regions de contact en siliciure auto-alignee pour la grille, la source et le drain d'un transistor a effet de champ a semi-conducteur metal-isolant (MISFET).

?

(FILE 'HOME' ENTERED AT 10:33:44 ON 01 JUL 2003)

FILE 'CAPLUS' ENTERED AT 10:33:56 ON 01 JUL 2003

L1 220920 S AMORPHOUS OR AMORPHITI?
L2 984707 S SILICON? OR SI OR POLYSILICON? OR POLY()SILICON?
L3 5972 S LASER?(6N)ANNEAL?
L4 1063 S L1 AND L2 AND L3
L5 435 S L1(6N)L2(6N)L3
L6 324 S L1(3N)L2(3N)L3
L7 5170 S LASER?(2N)ANNEAL?
L8 996 S L1 AND L2 AND L7
L9 309 S L1(3N)L2(3N)L7
L10 289276 S XCR OR EXPLOSIVE(2N)RECRYSTALLI? OR CRYSTALLI?
L11 131 S L9 AND L10
L12 287911 S DOPING OR DOPED OR DOPANT?
L13 13 S L11 AND L12

=>

L13 ANSWER 2 OF 13 CAPLUS COPYRIGHT 2003 ACS

AN 2003:21257 CAPLUS

DN 138:81814

TI Semiconductor devices having crystallized silicon active regions
and fabrication of devices thereof

IN Nakanishi, Takeshi

PA Sharp Corp., Japan

SO Jpn. Kokai Tokkyo Koho, 7 pp.

CODEN: JKXXAF

DT Patent

LA Japanese

FAN.CNT 1

| | PATENT NO. | KIND | DATE | APPLICATION NO. | DATE |
|---|----------------|------|----------|-----------------|----------|
| PI | JP 2003007716 | A2 | 20030110 | JP 2001-182890 | 20010618 |
| PRAI | JP 2001-182890 | | 20010618 | | |
| AB The title fabrication involves (1) depositing an amorphous Si film on an insulative substrate, (2) doping a Ni crystg. catalyst material into the amorphous Si film, (3) laser annealing to crystallize the amorphous Si film, (4) doping into a gate insulator, a gate contact, and the crystd. Si film in the crystd. Si film, (4) forming a Si ₃ N ₄ interlayer insulator film, (5) high-pressure annealing .ltoreq.20 h at .ltoreq.600.degree. in N ₂ to provide. The process provides simultaneously gettering of the crystn. catalyst and activating and hydrogenating of the Si film in fabrication of TFTs. | | | | | |

L13 ANSWER 5 OF 13 CAPLUS COPYRIGHT 2003 ACS
AN 1999:233639 CAPLUS
DN 130:260676
TI Laser processing apparatus and process for annealing and crystallization of amorphous silicon films for semiconductor devices
IN Ishihara, Hiroaki; Nakashita, Kazuhisa; Ohnuma, Hideto; Tanaka, Nobuhiro; Adachi, Hiroki
PA Semiconductor Energy Laboratory Co., Ltd., Japan.
SO U.S., 19 pp., Division of U.S. Ser. No. 511,466.
CODEN: USXXAM
DT Patent
LA English
FAN.CNT 3

| | PATENT NO. | KIND | DATE | APPLICATION NO. | DATE |
|----|---------------|------|----------|-----------------|----------|
| PI | US 5891764 | A | 19990406 | US 1996-739192 | 19961030 |
| | JP 06295859 | A2 | 19941021 | JP 1992-322737 | 19921106 |
| | JP 3249606 | B2 | 20020121 | | |
| | JP 2001085353 | A2 | 20010330 | JP 2000-243484 | 19921113 |
| | JP 2002118077 | A2 | 20020419 | JP 2001-241486 | 19921113 |
| | US 5643801 | A | 19970701 | US 1995-511466 | 19950804 |

PRAI JP 1992-322737 A 19921106
JP 1992-328770 A 19921113
US 1993-145587 B3 19931104
US 1995-511466 A3 19950804

AB A laser processing process which comprises laser annealing a Si film 2 .mu.m or less in thickness by irradiating a laser beam 400 nm or less in wavelength and being operated in pulsed mode with a pulse width of 50 ns or more, and preferably, 100 ns or more. A laser processing app. which comprises a laser generation device and a stage for mounting thereon a sample provided sep. from said device, to thereby prevent transfer of vibration attributed to the movement of the stage to the laser generation device and the optical system. A stable laser beam can be obtained to thereby improve productivity.

RE.CNT 15 THERE ARE 15 CITED REFERENCES AVAILABLE FOR THIS RECORD
ALL CITATIONS AVAILABLE IN THE RE FORMAT

L13 ANSWER 13 OF 13 CAPLUS COPYRIGHT 2003 ACS
AN 1980:120384 CAPLUS
DN 92:120384
TI Laser annealing of glow discharge amorphous silicon
AU Sussmann, R. S.; Harris, A. J.; Ogden, R.
CS Allen Clark Res. Cent., Plessey Res. (Caswell) Ltd., Caswell/Towcester, UK
SO Journal of Non-Crystalline Solids (1980), 35-36(1), 249-54
CODEN: JNCSBJ; ISSN: 0022-3093
DT Journal
LA English
AB Glow-discharge-deposited amorphous Si layers were annealed by a Q-switched ruby laser. The properties of the annealed films were studied as a function of laser energy by electron microscopy, photoluminescence and IR absorption. The changes in structure, H content, bandgap, and d. of states in the annealed layers are discussed. There are considerable similarities between amorphous and annealed materials.

=>

| Set | Items | Description |
|--------------|--|---|
| S1 | 531284 | AMORPHOUS OR AMORPHITI? |
| S2 | 2183217 | SILICON? OR SI OR POLYSILICON? OR POLY()SILICON? |
| S3 | 645482 | DOPING OR DOPED OR DOPANT? ? |
| S4 | 3473 | (POLYCRYSTALL? OR POLY()CRYSTAL?) (3N) GATE? ? |
| S5 | 1019146 | XCR OR EXPLOSIVE(2N) RECRYSTALLI? OR CRYSTALLI? |
| S6 | 102380 | (LASER? OR RADIANT(2N) ENERGY) (6N) (ANNEAL? OR THERMAL OR HE- AT????) |
| S7 | 114678 | S1(3N)S2 |
| S8 | 109858 | S1(2N)S2 |
| S9 | 15662 | S3 AND S8 AND S7 |
| S10 | 6567 | S9 AND (LAYER? OR REGION? OR SECTION?) |
| S11 | 73 | S5 AND S10 AND S6 |
| S12 | 1877 | S5(6N)S6 |
| S13 | 22 | S10 AND S12 |
| S14 | 20 | RD (unique items) |
| S15 | 18 | S14 AND PY<=2001 |
| ? show files | | |
| File | 2:INSPEC 1969-2003/Jun W4 | |
| | (c) 2003 Institution of Electrical Engineers | |
| File | 6:NTIS 1964-2003/Jun W5 | |
| | (c) 2003 NTIS, Intl Cpyrght All Rights Res | |
| File | 8:Ei Compendex(R) 1970-2003/Jun W4 | |
| | (c) 2003 Elsevier Eng. Info. Inc. | |
| File | 34:SciSearch(R) Cited Ref Sci 1990-2003/Jun W5 | |
| | (c) 2003 Inst for Sci Info | |
| File | 434:SciSearch(R) Cited Ref Sci 1974-1989/Dec | |
| | (c) 1998 Inst for Sci Info | |
| File | 99:Wilson Appl. Sci & Tech Abs 1983-2003/May | |
| | (c) 2003 The HW Wilson Co. | |
| File | 94:JICST-EPlus 1985-2003/Jun W4 | |
| | (c) 2003 Japan Science and Tech Corp (JST) | |
| File | 35:Dissertation Abs Online 1861-2003/Jun | |
| | (c) 2003 ProQuest Info&Learning | |
| File | 65:Inside Conferences 1993-2003/Jun W5 | |
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| File | 144:Pascal 1973-2003/Jun W3 | |
| | (c) 2003 INIST/CNRS | |
| File | 347:JAPIO Oct 1976-2003/Feb (Updated 030603) | |
| | (c) 2003 JPO & JAPIO | |
| File | 350:Derwent WPIX 1963-2003/UD,UM &UP=200341 | |
| | (c) 2003 Thomson Derwent | |
| File | 315:ChemEng & Biotec Abs 1970-2003/May | |
| | (c) 2003 DECHEMA | |
| ? | | |

15/9/3 (Item 3 from file: 2)

DIALOG(R)File 2:INSPEC

(c) 2003 Institution of Electrical Engineers. All rts. reserv.

02397447 INSPEC Abstract Number: A85028310, B85010736

Title: Multiple layer sputter deposition and laser annealing of silicon films

Author(s): Anderson, W.W.; MacMillan, H.F.; Katzeff, J.S.; Lopez, M.
Author Affiliation: Lockheed Missiles & Space Co. Inc., Sunnyvale, CA,
USA

Conference Title: Energy Beam-Solid Interactions and Transient Thermal Processing Symposium p.241-6

Editor(s): Fan, J.C.C.; Johnson, N.M.
Publisher: North-Holland, New York, NY, USA
Publication Date: 1984 Country of Publication: USA xviii+791 pp.

ISBN: 0 444 00903 5
Conference Sponsor: U.S. Army Res. Office

Conference Date: 14-17 Nov. 1983 Conference Location: Boston, MA, USA
Language: English Document Type: Conference Paper (PA)

Treatment: Experimental (X)

Abstract: The formation of single crystal multiple layers on silicon substrates with thicknesses in excess of 1 μ m has been demonstrated to be a viable process. Film build-up is via repetitions of the steps (1) pre-deposition chemical cleaning of wafer, (2) magnetron sputter deposition of 0.3 μ m thick amorphous Si, (3) interfacial mixing via 190 keV implantation of Si, and (4) film epitaxial crystallization via pulsed laser annealing. Doping has been demonstrated by both (1) P ion implantation and (2) P incorporation from PH₃/sub 3/ included in the sputter gas ambient. (15 Refs)

Subfile: A B
Descriptors: crystallisation; elemental semiconductors; epitaxial growth; ion implantation; laser beam annealing; semiconductor doping; semiconductor epitaxial layers; semiconductor growth; silicon; sputter deposition

Identifiers: Si films; doping; semiconductor; laser annealing; single crystal multiple layers; chemical cleaning; magnetron sputter deposition; amorphous Si; interfacial mixing; film epitaxial crystallization; P ion implantation; sputter gas ambient

Class Codes: A6170T (Doping and implantation of impurities); A6180B (Ultraviolet, visible and infrared radiation); A6855 (Thin film growth, structure, and epitaxy); A8115C (Deposition by sputtering); B0510D (Epitaxial growth); B2520C (Elemental semiconductors); B2550B (Semiconductor doping)

15/9/4 (Item 4 from file: 2)

DIALOG(R)File 2:INSPEC

(c) 2003 Institution of Electrical Engineers. All rts. reserv.

02063401 INSPEC Abstract Number: A83056948, B83033938

Title: Competition between solid phase epitaxy and random crystallization during CW laser annealing of amorphous Si films

Author(s): Roth, J.A.; Kokorowski, S.A.; Olson, G.L.; Hess, L.D.
Author Affiliation: Hughes Res. Labs., Malibu, CA, USA
Conference Title: Laser and Electron Beam Interactions with Solids.

Proceedings of the Materials Research Society Annual Meeting p.169-76

Editor(s): Appleton, B.R.; Celler, G.K.
Publisher: North-Holland, Amsterdam, Netherlands
Publication Date: 1982 Country of Publication: Netherlands 832 pp.
ISBN: 0 444 00693 1

Conference Date: 16-19 Nov. 1981 Conference Location: Boston, MA, USA

Language: English Document Type: Conference Paper (PA)

Treatment: Experimental (X)

Abstract: The kinetics of amorphous-to-polycrystalline conversion and solid phase epitaxy (SPE) in UHV-deposited Si films have been determined over a wide temperature range by the use of optical reflectivity measurements made during rapid heating by a CW Ar laser.

Crystallization rates measured in UHV following film deposition are reported and compared to rates measured in air in order to elucidate the effects of contaminants on the processes. The effects of boron doping of nucleation and growth kinetics are also reported. The crystallization rates determined in these studies can be used to predict the volume fraction of polycrystalline material formed during laser-induced SPE growth of thick epitaxial layers. (11 Refs)

Subfile: A B

Descriptors: amorphous semiconductors; boron; elemental semiconductors; epitaxial growth; laser beam annealing; nucleation; recrystallisation; reflectivity; semiconductor doping; semiconductor thin films; silicon

Identifiers: UHV deposited film; B doping; elemental semiconductor; solid phase epitaxy; random crystallization; CW laser annealing; amorphous Si films; optical reflectivity; contaminants; nucleation; growth kinetics; volume fraction of polycrystalline material; thick epitaxial layers

Class Codes: A6180B (Ultraviolet, visible and infrared radiation); A6855 (Thin film growth, structure, and epitaxy); B2520C (Elemental semiconductors); B2520F (Amorphous and glassy semiconductors); B2550B (Semiconductor doping); B4360 (Laser applications)

15/9/5 (Item 5 from file: 2)

DIALOG(R)File 2:INSPEC

(c) 2003 Institution of Electrical Engineers. All rts. reserv.

01495911 INSPEC Abstract Number: B80018977

Title: Fabrication of ultra-thin, high quality, single-crystal silicon membranes

Author(s): Petersen, K.E.

Author Affiliation: IBM Corp., Armonk, NY, USA

Journal: IBM Technical Disclosure Bulletin vol.22, no.5 p.2080-1

Publication Date: Oct. 1979 Country of Publication: USA

CODEN: IBMTAA ISSN: 0018-8689

Language: English Document Type: Journal Paper (JP)

Treatment: Practical (P)

Abstract: It is proposed that a heavily doped n⁺ substrate should be coated by chemical vapor deposition with a polysilicon or amorphous silicon film to the desired thickness, with the desired dopant level (films <or approximately=1000 Å are readily achievable). Next the wafer is laser annealed to crystallize the top silicon layer with the same crystallographic orientation as the substrate. Since the laser anneal step is so rapid and localized at the surface, very little additional diffusion of dopant will occur in contrast to epitaxial depositions. Then the substrate can be etched away either electrochemically or by a dopant selective etch, leaving a very thin, single-crystal membrane of high quality, with any desired dopant level. Membranes fabricated by this method will be much thinner than with any other technique; thickness and uniformity will also be much easier to control. (0 Refs)

Subfile: B

Descriptors: CVD coatings; etching; membranes; semiconductor doping; silicon

Identifiers: crystallographic orientation; laser anneal; dopant

selective etch; high quality; single crystal Si membranes; chemical vapour deposition; ultrathin membranes
Class Codes: B0520F (Vapour deposition); B2520C (Elemental semiconductors); B2550 (Semiconductor device technology)

15/9/12 (Item 1 from file: 347)
DIALOG(R)File 347:JAPIO
(c) 2003 JPO & JAPIO. All rts. reserv.

05852361 **Image available**
THIN FILM TRANSISTOR AND ITS MANUFACTURE

PUB. NO.: 10-135461 [JP 10135461 A]
PUBLISHED: May 22, 1998 (19980522)
INVENTOR(s): HINO TAKASHI
APPLICANT(s): TOSHIBA ELECTRON ENG CORP [486766] (A Japanese Company or Corporation), JP (Japan)
TOSHIBA CORP [000307] (A Japanese Company or Corporation), JP (Japan)
APPL. NO.: 08-285029 [JP 96285029]
FILED: October 28, 1996 (19961028)
INTL CLASS: [6] H01L-029/786; G02F-001/136; H01L-021/336
JAPIO CLASS: 42.2 (ELECTRONICS -- Solid State Components); 29.2 (PRECISION INSTRUMENTS -- Optical Equipment)
JAPIO KEYWORD: R002 (LASERS); R011 (LIQUID CRYSTALS); R096 (ELECTRONIC MATERIALS -- Glass Conductors); R097 (ELECTRONIC MATERIALS -- Metal Oxide Semiconductors, MOS)

ABSTRACT

PROBLEM TO BE SOLVED: To realize cost down by reducing the number of PEPs of a process.

SOLUTION: An amorphous silicon film in which n+ is doped is formed on a glass substrate 11, n-type high concentration regions 12 are formed, an i-type amorphous silicon film is deposited and is crystallized by laser annealing, elements are isolated, and an n-type active layer 13 and a p-type active layer 14 are formed. Subsequently, a gate electrode 16a for a p-type transistor is formed on the active layer 13 by forming and etching a gate insulating film 15 and depositing a material forming a gate electrode on the film 15. A part on the active layer 14 is left as a mask for an MoW 16b, a p-type high concentration region is formed in the active layer 14 by implanting high concentration impurities, and a gate electrode for an n-type transistor is formed by etching. A low concentration region is formed in the active layer 14 by implanting low concentration impurities, an interlayer insulating film is formed, contact holes are opened in the interlayer insulating film, a metal film is deposited on the contact holes, and a signal line is formed by etching.

15/9/13 (Item 2 from file: 347)
DIALOG(R)File 347:JAPIO
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05487812 **Image available**
MANUFACTURE OF SEMICONDUCTOR DEVICE

PUB. NO.: 09-102612 [JP 9102612 A]
PUBLISHED: April 15, 1997 (19970415)

INVENTOR(s) : HINO TAKASHI
APPLICANT(s) : TOSHIBA ELECTRON ENG CORP [486766] (A Japanese Company or Corporation), JP (Japan)
TOSHIBA CORP [000307] (A Japanese Company or Corporation), JP (Japan)
APPL. NO.: 07-260385 [JP 95260385]
FILED: October 06, 1995 (19951006)
INTL CLASS: [6] H01L-029/786; H01L-021/336; G02F-001/136; H01L-021/265;
H01L-021/268
JAPIO CLASS: 42.2 (ELECTRONICS -- Solid State Components); 29.2 (PRECISION INSTRUMENTS -- Optical Equipment)
JAPIO KEYWORD: R002 (LASERS); R096 (ELECTRONIC MATERIALS -- Glass Conductors); R100 (ELECTRONIC MATERIALS -- Ion Implantation)

ABSTRACT

PROBLEM TO BE SOLVED: To provide a method of manufacturing a semiconductor device wherein the dissolving of a problem of uniformity of film quality of a polycrystalline silicon film in a low temperature process, the improvement of annihilation ratio of crystal defect, the improvement of characteristics of a thin film transistor, and the uniforming of characteristics in a substrate are possible.

SOLUTION: An amorphous silicon film 12 is doped with fluorine before crystallization of a polycrystalline silicon film 13 not through an oxide film, before an element isolation process, by combining laser annealing with fluorine doping. After that, crystallization of the amorphous silicon film 12 and activation of fluorine are simultaneously performed by laser annealing. Thereby crystal defect in an active layer film 14 is annihilated, and characteristics of film quality is improved as a whole. Hence, the problem of uniformity of film quality of the active layer film 14 is dissolved, and excellent characteristics of a polycrystalline silicon thin film transistor in a low temperature process can be obtained in a large-sized substrate without irregularity.

15/9/14 (Item 1 from file: 350)
DIALOG(R)File 350:Derwent WPIX
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013941059 **Image available**
WPI Acc No: 2001-425273/ 200145
XRAM Acc No: C01-128650
XRPX Acc No: N01-315522

Top gate amorphous silicon thin film transistor production for flat panel display comprises laser annealing areas not shielded by gate conductor to form polysilicon portions with diffused impurities

Patent Assignee: KONINK PHILIPS ELECTRONICS NV (PHIG)

Inventor: BATTERSBY S J

Number of Countries: 028 Number of Patents: 004

Patent Family:

| Patent No | Kind | Date | Applicat No | Kind | Date | Week | |
|---------------|------|----------|----------------|------|----------|--------|---|
| WO 200139265 | A1 | 20010531 | WO 2000EP10904 | A | 20001102 | 200145 | B |
| EP 1147551 | A1 | 20011024 | EP 2000983109 | A | 20001102 | 200171 | |
| | | | WO 2000EP10904 | A | 20001102 | | |
| KR 2001093264 | A | 20011027 | KR 2001708995 | A | 20010716 | 200223 | |
| JP 2003515928 | W | 20030507 | WO 2000EP10904 | A | 20001102 | 200331 | |
| | | | JP 2001540835 | A | 20001102 | | |

Priority Applications (No Type Date): GB 9927287 A 19991119
Patent Details:

Patent No Kind Lan Pg Main IPC Filing Notes
WO 200139265 A1 E 21 H01L-021/336
Designated States (National): JP KR
Designated States (Regional): AT BE CH CY DE DK ES FI FR GB GR IE IT LU
MC NL PT SE TR
EP 1147551 A1 E H01L-021/336 Based on patent WO 200139265
Designated States (Regional): AL AT BE CH CY DE DK ES FI FR GB GR IE IT
LI LT LU LV MC MK NL PT RO SE SI TR
KR 2001093264 A H01L-029/786
JP 2003515928 W 19 H01L-021/336 Based on patent WO 200139265

Abstract (Basic): WO 200139265 A1

NOVELTY - Doped silicon source and drain regions (6a,8a) in a thin-film transistor underlie an amorphous silicon layer (12) so that laser annealing then results in full crystallization of the amorphous silicon layer .

DETAILED DESCRIPTION - A top gate thin-film transistor is produced by forming doped silicon source and drain regions (6a,8a) on an insulating substrate, carrying out plasma treatment, forming an amorphous silicon layer (12) followed by an insulated gate structure (14,16) and laser annealing areas not shielded by gate conductor to form polysilicon portions having diffused impurities.

An INDEPENDENT CLAIM is also included for a transistor formed as above.

USE - In forming thin-film transistors (claimed)

ADVANTAGE - The amorphous silicon layer is fully crystallized, reducing resistance and preventing peeling from the electrodes.

DESCRIPTION OF DRAWING(S) - The figure shows a cross- section of the transistor.

Source and drain regions (6a,8a)

Amorphous silicon layer (12)

Insulated gate structure (14,16)

pp; 21 DwgNo 2/3

Title Terms: TOP; GATE; AMORPHOUS; SILICON; THIN; FILM; TRANSISTOR; PRODUCE ; FLAT; PANEL; DISPLAY; COMPRISE; LASER; ANNEAL; AREA; SHIELD; GATE; CONDUCTOR; FORM; PORTION; DIFFUSION; IMPURE

Derwent Class: L03; P81; U11; U12; U14

International Patent Class (Main): H01L-021/336; H01L-029/786

International Patent Class (Additional): G02F-001/1343; G02F-001/136; G02F-001/1368; H01L-021/20; H01L-021/225; H01L-021/268

File Segment: CPI; EPI; EngPI

Manual Codes (CPI/A-N): L03-G04A; L03-G05; L04-C10B; L04-E01

Manual Codes (EPI/S-X): U11-C03D; U11-C03J1; U11-C18A1; U12-B03A; U12-Q; U14-K01A2B

15/9/15 (Item 2 from file: 350)
DIALOG(R)File 350:Derwent WPIX
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013841375 **Image available**

WPI Acc No: 2001-325588/ 200134

XRAM Acc No: C03-036098

XRPA Acc No: N03-112258

Polysilicon thin film transistor manufacturing method for liquid crystal display, dynamic random access memory, involves crystallizing amorphous silicon layer formed n substrate by sequential lateral solidification laser annealing

Patent Assignee: LG PHILIPS LCD CO LTD (GLDS)

Inventor: CHUNG Y H; JUNG Y H
Number of Countries: 002 Number of Patents: 003

Patent Family:

| Patent No | Kind | Date | Applicat No | Kind | Date | Week |
|---------------|------|----------|---------------|------|----------|----------|
| KR 2000074373 | A | 20001215 | KR 9918275 | A | 19990520 | 200134 B |
| US 6475872 | B1 | 20021105 | US 2000573350 | A | 20000519 | 200314 |
| KR 333275 | B | 20020424 | KR 9918275 | A | 19990520 | 200270 |

Priority Applications (No Type Date): KR 9918275 A 19990520

Patent Details:

| Patent No | Kind | Lan Pg | Main IPC | Filing Notes |
|---------------|------|--------|--------------|-------------------------------------|
| KR 2000074373 | A | | G02F-001/136 | |
| US 6475872 | B1 | 7 | H01L-021/20 | |
| KR 333275 | B | | G02F-001/136 | Previous Publ. patent KR 2000074373 |

Abstract (Basic): US 6475872 B1

NOVELTY - Amorphous silicon layer formed on substrate (210) is crystallized using sequential lateral solidification (SLS) laser annealing technique to form polysilicon layer. Gate insulating layer (240) and gate electrode (250) are formed on polysilicon layer. Polysilicon layer is ion-doped to form source and drain regions (230b, 230c).

DETAILED DESCRIPTION - Gate electrode and source and drain regions are activated using SLS laser annealing technique.

USE - The method is used for manufacturing polysilicon thin film transistor (TFT) used in high density static random access memory (SRAM) for load pull-up device. The TFT is also used as switching element and peripheral drive circuit in large-area active matrix liquid crystal display (LCD).

ADVANTAGE - By crystallizing the amorphous silicon layer using SLS laser annealing technique, polysilicon layer with dense and uniform-sized grains is obtained. Hence the electric characteristics of the transistor are improved and low-resistant gate electrode is obtained.

DESCRIPTION OF DRAWING(S) - The figure shows a cross-sectional view illustrating the TFT manufacturing method.

Substrate (210)

Source and drain regions (230b, 230c)

Gate insulating layer (240)

Gate electrode (250)

pp; 7 DwgNo 3C/3

Title Terms: THIN; FILM; TRANSISTOR; MANUFACTURE; METHOD; LIQUID; CRYSTAL; DISPLAY; DYNAMIC; RANDOM; ACCESS; MEMORY; CRYSTAL; AMORPHOUS; SILICON; LAYER ; FORMING; SUBSTRATE; SEQUENCE; LATERAL; SOLIDIFICATION; LASER; ANNEAL

Derwent Class: L03; P81; U11; U12; U13; U14

International Patent Class (Main): G02F-001/136; H01L-021/20

File Segment: CPI; EPI; EngPI

Manual Codes (CPI/A-N): L03-G04A; L03-G05B; L04-C02B; L04-C03; L04-C10B; L04-C11C1; L04-C12; L04-C16A; L04-E01E

Manual Codes (EPI/S-X): U11-C03D; U11-C03J2A; U11-C05F5; U11-C18A1; U12-B03A; U12-Q; U13-C04B1B; U14-A03B1; U14-H01A; U14-K01A2B

15/9/16 (Item 3 from file: 350)

DIALOG(R)File 350:Derwent WPIX

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013770820 **Image available**

WPI Acc No: 2001-255031/ 200126

Related WPI Acc No: 2001-189746

XRAM Acc No: C01-083154

XRPX Acc No: N01-195679

Manufacture of thin film transistor by depositing amorphous silicon on substrate and patterning to form active layer , heavily doping impurities in active layer , and converting active layer of amorphous silicon to polysilicon

Patent Assignee: LG PHILIPS LCD CO LTD (GLDS)

Inventor: LEE J H; LEE S G; LEE S; YI J

Number of Countries: 002 Number of Patents: 003

Patent Family:

| Patent No | Kind | Date | Applicat No | Kind | Date | Week |
|---------------|------|----------|-------------|------|----------|----------|
| KR 2000061176 | A | 20001016 | KR 9910051 | A | 19990324 | 200126 B |
| US 6207481 | B1 | 20010327 | US 99458468 | A | 19991209 | 200129 |
| KR 317622 | B | 20011222 | KR 9910051 | A | 19990324 | 200250 |

Priority Applications (No Type Date) : KR 9910051 A 19990324

Patent Details:

| Patent No | Kind | Lan Pg | Main IPC | Filing Notes |
|---------------|------|--------|--------------|-------------------------------------|
| KR 2000061176 | A | | H01L-029/786 | |
| US 6207481 | B1 | 19 | H01L-029/786 | |
| KR 317622 | B | | H01L-029/786 | Previous Publ. patent KR 2000061176 |

Abstract (Basic): US 6207481 B1

NOVELTY - A thin film transistor is manufactured by depositing amorphous silicon on substrate and patterning the deposited amorphous silicon to form an active layer , heavily doping impurities in the active layer using gate electrode as mask to form source and drain region in the active layer , and converting active layer from amorphous silicon to polysilicon through metal induced crystallization process.

DETAILED DESCRIPTION - Manufacture of thin film transistor involves depositing amorphous silicon on a substrate and patterning to form an active layer (218). A block layer is formed centrally located on the active layer to function as mask during an impurity doping process so that a channel region is defined in an approximately central portion in the active layer . An exposed surface of the active layer is silicidized to form a crystallization seed layer (224), and the block layer is then removed. A gate insulating layer (226) is formed on the substrate to cover the active layer and the crystallization seed layer . A gate electrode (228) is defined on the gate insulating layer so that the gate electrode is located on a portion which corresponds to the channel region of the active layer , with the gate electrode overlapping with a portion of the crystallization seed layer . The active layer is heavily doped with impurities using the gate electrode as a mask to form source and drain regions (230, 231) in the active layer from amorphous silicon to polysilicon through a metal induced lateral crystallization process caused by the crystallization seed layer .

USE - For manufacturing a thin film transistor used as switching devices for a pixel block and driving devices for a driver circuit block in an active matrix type liquid crystal display.

ADVANTAGE - The active layer is formed of polysilicon providing crystals, which are uniform in size, making the electrical properties of the resulting transistor uniform. The source and drain regions are not in direct contact with first and second interconnecting layers so that oxidation of the source and drain regions is avoided to prevent the contact resistance from increasing.

DESCRIPTION OF DRAWING(S) - The figure shows a cross- sectional view of a process for manufacturing the thin film transistor.

Active layer (218)
Crystallization seed layer (224)
Gate insulating layer (226)
Gate electrode (228)
Source and drain regions (230, 231)
pp; 19 DwgNo 6E/7

Technology Focus:

TECHNOLOGY FOCUS - ELECTRONICS - Preferred Method: The method further comprises forming a buffer layer on the substrate. The crystallization seed layer is formed by depositing a high melting point metal, and silicidizing a boundary by a spontaneous reaction of the active layer and the deposited high melting point metal. The impurities inside the active layer are activated to crystallize the active layer by using laser radiation or by heat treatment at 400-600degreesC for 1-3 hours.

INORGANIC CHEMISTRY - Preferred Components: The buffer layer is silicon oxide or silicon nitride. The high melting point metal can be titanium, chrome, nickel, molybdenum, tantalum, cobalt, platinum, or tungsten. The block layer is made of silicon nitride or silicon oxide having a different etching selection ratio than the buffer layer .

Title Terms: MANUFACTURE; THIN; FILM; TRANSISTOR; DEPOSIT; AMORPHOUS; SILICON; SUBSTRATE; PATTERN; FORM; ACTIVE; LAYER ; HEAVY; DOPE; IMPURE; ACTIVE; LAYER ; CONVERT; ACTIVE; LAYER ; AMORPHOUS; SILICON

Derwent Class: L03; U11; U12; U14

International Patent Class (Main): H01L-029/786

File Segment: CPI; EPI

Manual Codes (CPI/A-N): L04-C02; L04-C03; L04-C04; L04-C06; L04-C10B;
L04-C10H

Manual Codes (EPI/S-X): U11-C01J2; U11-C03D; U11-C03J1; U11-C18A1; U12-B03A
; U12-Q; U14-K01A2B

15/9/18 (Item 5 from file: 350)

DIALOG(R)File 350:Derwent WPIX

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010049567 **Image available**

WPI Acc No: 1994-317278/ 199439

XRAM Acc No: C94-144602

XRPA Acc No: N94-249094

Solid state imaging device and manufacture - has MOS structure and non-single crystal silicon

Patent Assignee: SEMICONDUCTOR ENERGY LAB (SEME); TDK CORP (DENK)

Inventor: ARAI M; CODAMA M; INUSHIMA T; KOBORI I; SAKAMOTO N; SUGIURA K;
TAKAYAMA I; YAMAUCHI Y

Number of Countries: 018 Number of Patents: 009

Patent Family:

| Patent No | Kind | Date | Applicat No | Kind | Date | Week |
|------------|------|----------|-------------|------|----------|----------|
| WO 9422173 | A1 | 19940929 | WO 94JP452 | A | 19940322 | 199439 B |
| JP 6342899 | A | 19941213 | JP 9363789 | A | 19930323 | 199509 |
| EP 642179 | A1 | 19950308 | EP 94910053 | A | 19940322 | 199514 |
| | | | WO 94JP452 | A | 19940322 | |
| JP 7142694 | A | 19950602 | JP 93314135 | A | 19931119 | 199531 |
| EP 642179 | A4 | 19950830 | EP 94910053 | A | 19940000 | 199618 |
| US 5574293 | A | 19961112 | WO 94JP452 | A | 19940322 | 199651 |
| | | | US 94343492 | A | 19941122 | |
| US 5591988 | A | 19970107 | WO 94JP452 | A | 19940322 | 199708 |
| | | | US 94343492 | A | 19941122 | |
| | | | US 95477104 | A | 19950607 | |
| EP 642179 | B1 | 19990203 | EP 94910053 | A | 19940322 | 199910 |

| | | | |
|-------------|------------|-------------|-------------------|
| DE 69416363 | E 19990318 | WO 94JP452 | A 19940322 |
| | | DE 616363 | A 19940322 199917 |
| | | EP 94910053 | A 19940322 |
| | | WO 94JP452 | A 19940322 |

Priority Applications (No Type Date): JP 93314135 A 19931119; JP 9363789 A 19930323

Cited Patents: CH 596671; DE 2541117; EP 165764; FR 2284984; JP 2181419; JP 3009562; JP 323671; JP 5154790; JP 61007663; JP 63029924; NL 7510655; US 4598305; 2.Jnl.Ref; JP 2210877

Patent Details:

| Patent No | Kind | Lan Pg | Main IPC | Filing Notes |
|-------------|------|--------|--------------|---|
| WO 9422173 | A1 | | H01L-031/113 | |
| | | | | Designated States (National): US |
| | | | | Designated States (Regional): AT BE CH DE DK ES FR GB GR IE IT LU MC NL PT SE |
| JP 6342899 | A | 9 | H01L-027/146 | |
| EP 642179 | A1 E | 26 | H01L-031/113 | Based on patent WO 9422173 |
| | | | | Designated States (Regional): DE FR GB NL |
| JP 7142694 | A | 8 | H01L-027/146 | |
| US 5574293 | A | 17 | H01L-031/062 | Based on patent WO 9422173 |
| US 5591988 | A | 18 | H01L-029/04 | Div ex application WO 94JP452 Div ex application US 94343492 |
| EP 642179 | B1 E | | H01L-031/113 | Based on patent WO 9422173 |
| | | | | Designated States (Regional): DE FR GB NL |
| DE 69416363 | E | | H01L-031/113 | Based on patent EP 642179 Based on patent WO 9422173 |
| EP 642179 | A4 | | H01L-031/113 | |

Abstract (Basic): WO 9422173 A

An active layer (3') consisting of non-single-crystal silicon is formed by a thin-film technology on a substrate (1) coated with an insulation layer (2), and a gate electrode layer (5') is partially disposed on the active layer (3') through a gate insulation layer (4'). An imaging device having a MOS structure can be obtained by introducing P- or N-type impurity into the active layer (3'). A bias voltage is applied to the gate electrode in such a manner that forward current flows between source and drain. When input light is applied to the active layer between the source and the drain through the gate electrode or the substrate, an electric output corresponding to the input light is obtained from the source or the drain. MOS transistors are provided on the substrate (1) to form switching devices and shift registers, which are necessary for the operation of the imaging device. The active layer (3') can be obtained by crystallising an amorphous silicon layer by laser annealing or high temperature annealing with hydrogenation, and a trap density less than $5 \times 10^{11}/\text{cm}^2$ is realised.

ADVANTAGE - The light response time of the imaging device is several hundreds of microseconds (micro-secs.), that is, 10 times or higher than the response of a conventional photosensor using amorphous silicon.

Dwg.1/12

Abstract (Equivalent): US 5574293 A

A method for producing a solid state image sensor having a thin film transistor comprising the steps of; providing a silicon oxide layer on a substrate, providing an amorphous silicon layer on the silicon oxide layer by using disilane gas, providing a crystallized non-single crystal silicon layer by annealing the amorphous silicon layer by illuminating the amorphous silicon layer with a laser beam of short pulse width so that the trap density

of the silicon layer is less than 5multiplied by $10^{11}/cm^2$, providing an island of the crystallized non-single crystal silicon layer , the island being an active layer , providing a gate insulation layer and a gate electrode layer on the active layer , and doping impurities in the active layer to provide a source regi n and a drain region

Dwg.0/12

US 5591988 A

A solid state image sensor comprising; a substrate having insulation surface, an active layer of non-single crystal silicon layer provided on the insulation surface, having at least a source region and a drain region , a gate electrode layer provided on light receiving region between the source region and the drain region on the active layer through a gate insulation layer , a source electrode layer and a drain electrode layer each provided on the source region and the drain region , respectively, trap density of the active layer being less than $5 \times 10^{11}/cm^2$, the gate electrode layer being provided a predetermined bias potential, and electrical output of current between the source electrode layer and the drain electrode layer being provided depending upon input light which illuminates the light receiving region on the active layer .

Dwg.1/12

Title Terms: SOLID; STATE; IMAGE; DEVICE; MANUFACTURE; MOS; STRUCTURE; NON; SINGLE; CRYSTAL; SILICON

Derwent Class: L03; U11; U13; U14

International Patent Class (Main): H01L-027/146; H01L-029/04; H01L-031/062; H01L-031/113

International Patent Class (Additional): H01L-029/784; H01L-029/786; H01L-031/036; H01L-031/0376; H01L-031/10; H01L-031/20

File Segment: CPI; EPI

Manual Codes (CPI/A-N): L04-C02; L04-C11C; L04-E01B; L04-E05

Manual Codes (EPI/S-X): U11-C18A1; U13-A01B; U14-H01B

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